IMPACT OF PETROLEUM PRODUCT PRICE ON HUMAN WELFARE IN NIGERIA

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Abstract. The single most important issue confronting a growing number of world economies today is the price of oil and its attendant consequences on economic output. Therefore the study investigated the impact of petroleum pump price on human welfare in Nigeria over the period 1990 to 2015. The study employed expost facto research design. Secondary time series data were used for the study and these were sourced from World Development Indicator *(WDI, 2015)* and Central Bank of Nigeria statistical bulletin, *(CBN, 2015)*. The data collected were analyzed using autoregressive distributed lag. The inferences were drown at 1% and 5% significance level. The result showed that premium motor spirit price and dual purpose kerosene price exert a long-run negative and significant impact on human welfare in Nigeria (β = -0.15299, t = -5.31141 and β = -0.471399, t = -1.8838 respectively) while premium motor spirit price, dual purpose kerosene price and inflation rate exert a short-run negative and significant impact on human welfare in Nigeria (β = -0.71735, t= -4.3766; β = -0.62562, t = -2.9188 and β = -0.050310, t = -2.1829 respectively). The study concluded that as premium motor spirit price and dual purpose kerosene price and inflation rate increases, human welfare will fall and vice versa. Therefore for human welfare to increase, there must be a fall in premium motor spirit price and dual purpose kerosene price and inflation rate in Nigeria. The study recommended that Government and it agencies should ensure that petroleum pump prices should be regulated because they have a long way on the market. An increase in the price of petroleum products will lead to market failure because most products use either of these products. Since inflation rate worsen the welfare of people, the policy maker should find a way of control inflation in the system so that the welfare of the people will improve (better-off).

Keywords: Premium Motor Spirit (PMS), Automotive Gas Oil (AGO), Dual Purpose Kerosene (DPK), Inflation Rate (INF), Interest Rate (INT) and Human Development Index (HDI).

DOI: http://dx.doi.org/10.23856/2903

1 Introduction

Human welfare is the satisfaction of needs-food, drink, shelter and other things that contribute to 'bodily flourishing.' The presence or absence of such satisfaction is surely better measured by levels of health in the population than income. Standard economic theory begins by assuming that a household's (or an individual's) objective is to maximize utility given

certain constraints.' Utility is a construct that represents nothing other than household welfare *(Glewwe, 1991)*. Total expenditure consists of five components: Consumption expenditure on food and non-food (nondurable goods); value of home-product food consumed; value of goods in-kind received (such as food and housing) beside wages; estimated used value of durable goods owned by the household and rental value of the dwelling occupied by the household. Durable goods, once purchased, will certainly increase the wellbeing of a household for a certain period of time. The prices of these determine the amount one can get and the major problem of increase in any of this is the increase in petroleum pump price.

Nigerians were greeted with removal of petroleum fuel subsidy which resulted in increase on pump prices of petroleum product. Some arguments have it that it will be good for the economy while other argued that it will not favour the average Nigerian, especially those on grassroots. Again, the single most important issue confronting a growing number of world economies today is the price of oil and its attendant consequences on economic output. Oil plays a significant role in the Nigerian economy not only as the largest contributor in terms of total government revenue but also as the overall contributor in her exports composition *(Singh & Gupta, 2012)*. Several studies have investigated the effect of oil price shocks on levels of gross domestic product. Some of these studies include: the effect of crude oil prices on real GDP, the real interest rate, government spending, real government revenues, the real stock price, the real effective exchange rate, the real crude oil prices and inflation rate in India *(Singh & Gupta, 2012)*, effect of crude oil price on exchange rate *(Huang & Yi-Heng, 2010)*, effect of PMS price on inflation rate in Nigeria *(Arinze, 2011)*, "oil price fluctuations and the Nigerian economy". OPEC review: 199-217 *(Ayadi, 2005)*, oil price shock and macroeconomic activity in Nigeria *(Olomola & Adejumo, 2006)*. The majority of these researches was not conducted in Nigeria and where it was conducted, the core areas of the economy were overlooked. Therefore, this study is set to investigate the short-run and long-run relationship between premium motor spirit price, automotive gas oil price and dual purpose kerosene price and human welfare in Nigeria.

The rest of the section is divided into five sections and section two details stylized facts on petroleum product price in Nigeria. Section three presents the review of literature, while theoretical framework and methodology are contained in section four. Empirical analysis is made in section five and summary and conclusions are in section six.

2 Stylized facts on petroleum product price in Nigeria

Oil prices have increased dramatically since beginning of 2003,from $28.77 a barrel in 2003,the price of crude oil peak in August 2010 at $100.60, and closed at $81.07 in December2010.In addition, high domestic inflation and exchange rate deregulation contributed further to erode domestic petroleum prices vis-a-vis international benchmarks. The deregulation of exchange rate in 1999 and the resulting naira depreciation also accentuated a growing disparity between domestic and international petroleum product prices. By 2011, few people could dispute the need to reform Nigeria's domestic petroleum products prices. As international oil prices approached US $110 per barrel and f.o.b. gasoline prices hovered $1 per litre, Nigeria's domestic price of US$0.59 per litre of gasoline was clearly out of touch with reality, unsustainable, and unjustifiable by any economic theory. Gasoline accounts for the largest share of petroleum products consumption and also receives largest rate of subsidy. The subsidy level in 2008 alone was 150% of capital expenditure of the federal government in that year *(Hassan & Zahid, 2011)*. In 2006, subsidy payment on fuel

products was 50% of the size of federal government expenditure. The estimated subsidy payment is about 400% of the budgeted capital expenditures for human capital development. The landing cost of petrol plus margin as at May 2012 is N169.13. With this, it means the Federal Government is subsidizing petrol at the rate of N72.37 per litre given the fact that the product is sold for N97 per litre to the people. As at December 31, 2011 before the partial withdrawal of subsidy, it stood at 76 naira per litre but was reduced to N44 when the official price of petrol was pegged at N97 per litre. Oil subsidy has moved from being implicit to explicit from 1999. The subsidy payment in 2010 was amounted N1.25 billion. Nigeria spent 19 percent of her budget on subsidy payment in 2011. In addition, N656.3 billion allocated to subsidy is the second largest allocation in 2012. It came behind security which has the largest allocation of N921.91 billion. Also, provision of N231.8 billion was made for the payment of the 2011 subsidy arrears. These figures exceed total allocation to priority sectors of our economy. The recent development has revealed that most of the claims and payments are frauds. Some of the importers collected subsidy payments without importing products. Corruption accounts for the substantial part of the increase in the amount of fuel subsidy. That shows Nigeria is subsidizing inefficiencies, fraud and racketeering in the production and distribution chain *(Rolle & Uffie, 2015)*.

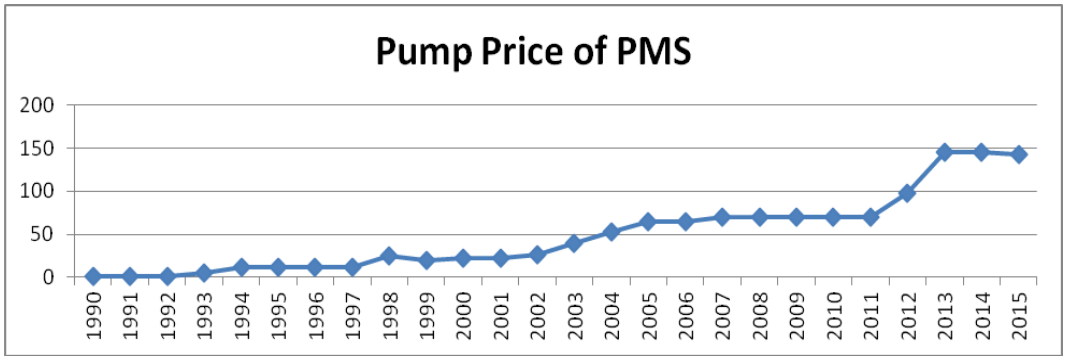

Fig. 2.1. Trend of Premium Motor Spirit (PMS) in Nigeria from 1990 - 2015
Source: Author's Computation

Also, the price of diesel has been fluacturing over time, it was N250 in 1990 and move to N259 while it increases from N265 to N271 between 1992 and 1993. In 1994, the price of diesel falls to N252 due of the economic meltdown while it increases to N284 and N286 respective between 1995 and 1996. There was a dramatic decrease in the price of automotive gas oil from N277 to N246 between 1997 and 2000 but after the return of democracy, the price of automotive gas oil in Nigeria has been up and down due to the deregulation of the sector. For example, the price of automotive gas oil was N306, N304, N288, N277 and N312 for five consecutive years from 2001 to 2005 respectively. In the same vein, the price of automotive gas oil fall four consecutive year from 2006 to 2009 with N284, N269, N269 and N243 respectively and from 2010 to 2015, the price of automotive gas oil will move up ad also go down due to the forces of demand and supply that prevail in the economy while in 2010, it was N283 and fall by one naira in 2015 where the price of automotive gas oil was N282.

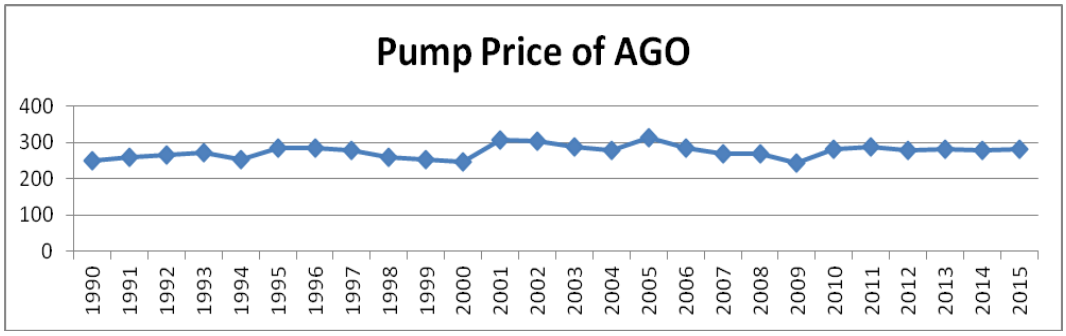

Fig. 2.2. Trend of Automotive Gas Oil (AGO) in Nigeria from 1990 - 2015
Source: Author's Computation

3 Literature Review

This section presents literature review on petroleum product price and human welfare. To start with developed countries,Qianqian, *(2011)* applied the co-integration and error correction model to specifically measure the impact of oil price on the economy. The results showed that there exist long-run equilibrium relationship between the oil price and the China's output, the consumer price index, the total amount of net exports and the monetary policy. Rising international oil price would cause the total amount of net exports and the real output to decline and the prices to ascend. Meanwhile, it would have a negative impact on the actual money supply. Difiglio, *(2014)* reviewed why the price-inelastic demand and supply of oil cause oil price shocks and why oil price shocks reduce economic growth through dislocations of labor and capital. The result of the study reviewed that strategic oil stocks have not been used in sufficient quantity or soon enough to avoid the economic downturns that followed past oil supply outages. In addition, the growth of U.S. oil production has reduced the ability of the U.S. Strategic Petroleum Reserve to protect the economy following a future oil supply disruption.

Bildiricia and Ersin, *(2015)* investigated the causality analysis among biomass energy consumption, oil prices and economic growth in Austria, Canada, Germany, Great Britain, Finland, France, Italy, Mexico, Portugal and the U.S. by using the autoregressive distributed lag bounds testing (ARDL) method, Granger causality and Toda and Yamamato non-causality test from 1970-2013 period. For Austria, Germany, Finland and Portugal, the Granger causality test determined the evidence that the conservation hypothesis is supported. In state of U.S., the feedback hypothesis highlights the interdependent relationship between biomass energy consumption and economic growth. Tado Yamamoto test determined, for Austria, Germany, Finland and Portugal, the conservation hypothesis is supported. In state of U.S., the feedback hypothesis highlights the interdependent relationship between biomass energy consumption and economic growth.

Based on the developing countries, Yazdana, Ehsanb and Sadr, *(2012)* investigated the causal relationship between oil prices and economic growth in Iran over a period from 1980 to 2010. Results showed that neutral effect of oil price on economic growth as such the significance for error-correction term is not statistically supported. Given the natural effect of oil prices on economic growth and the fact that Iran has adopted economic growth targeting as its policy anchor, we recommend that monetary policies should be relaxed during the global

oil price shocks in order to protect the country from any possible outcome of a full-blown stagflation scenario. Our results apply irrespective of whether the causality is estimated in the short-run or in the long-run.Bondzie, Bartolomeo and Fosu, *(2014)* investigated the oil price fluctuations and it impact on economic growth: A dynamic stochastic general equilibrium (DSGE) approach. The study realized that a shock on interest rate leads to a sharp fall in prices which reflects the impact of the decrease in interest rate on the marginal cost. There was a paradoxical effect of a negative interest rate on total money supply. The study also showed that a positive output shock has the same effect on consumption, investment, prices and wages as in the case of interest rate shock.

Akinlo and Apanisile, *(2015)* examined the impact of the volatility of oil price on economic growth in 20 sub-Saharan African countries from the period of 1986-2012. These countries were divided into group A and group B. Group A consists of 10 oil exporting countries, while group B consists of non-oil exporting countries in sub-Saharan Africa. The estimation of panel A model consisting of the oil exporting countries shows that the volatility of oil price has a positive and significance effect on the economic growth of oil exporting countries. The result of panel B consisting of non-oil producing countries shows that the volatility of oil price also has a positive and insignificant impact on economic growth. Dogah, *(2015)* employed a restricted VAR model and Johansen co-integration test to investigate the impact of oil price shocks on the macroeconomy of Ghana- a developing oil importing economy. The findings reveal that oil price shocks have significant negative impact on output and economic activities in Ghana. Also, the results indicated a nonlinear oil-price macroeconomy relationship but no evidence of asymmetric effects exist between oil price shocks and macroeconomic variables in Ghana.

Alom, *(2015)* examined the pass-through of crude oil prices (CP) into economic activities of Malaysia including industrial production index (IP), consumer price index (CPI), real effective exchange rate (REER), interest rate (IR) and stock price index (SPI) within the framework of hidden cointegration technique over the quarterly data ranging from 1987 to 2013. The estimated results suggest that positive and negative changes of IP, CPI, REER, IR and SPI do not maintain a long-run association with positive as well as negative changes of real CP. Gokmenoglua, Azina and Taspinar, *(2015)* investigated the relationship among the oil price, inflation, GDP and industrial production for 1961 to 2012 period in the case of Turkey. Three different tests, namely unit root, co-integration and causality tests, have been employed to investigate the relationship among the variables. The results of Phillips-Perron (PP) as a unit root test suggests that all the variables under investigation are integrated of order one; I (1). Johansen co-integration results confirm a long-run relationship among these variables and Granger causality test illustrates the unidirectional relationship from oil price to industrial production.

From studies in Nigeria,Gunu and Kilishi, *(2010)* examined the relationship between oil price shocks and the Nigeria economy: A variance autoregressive (VAR) model. The results showed that oil prices have significant impact on real GDP, money supply and unemployment. It impact on the fourth variable, consumer price index was not significant. This implies that three key macroeconomic variables in Nigeria are significantly explained by exogenous and the highly volatile variable. Hence, the economy was vulnerable to external shocks. Akpan, *(2012)* analyzed the dynamic relationship between oil price shocks and major macroeconomic variables in Nigeria by applying a VAR approach. The findings of the study showed a strong positive relationship between positive oil price changes and real government expenditures. Unexpectedly, the result identifies a marginal impact of oil price fluctuations on

industrial output growth. Furthermore, the "Dutch Disease" syndrome was observed through significant real effective exchange rate appreciation.Aremo, Orisadare and Ekperiware, *(2012)* examined the effect of oil price shock on fiscal policy in Nigeria by using structural vector auto-regression (SVAR) method within the study period of 1980:1 to 2009:4. The study also revealed that oil price shock affects GREV and GDP first before reflecting on fiscal expenditure. The study suggests strongly that diversification of the economy is necessary in order to minimize the consequences of oil price fluctuations on government revenue, by implication government expenditure planning in the country.

Oriakhi and Iyoha, *(2013)* examined the consequences of oil price volatility on the growth of the Nigerian economy within the period 1970 to 2010. The study find out that out of the six variables employed, oil price volatility impacted directly on real government expenditure, real exchange rate and real import, while impacting on real GDP, real money supply and inflation through other variables, notably real government expenditure. Ogundipe, Ojeaga and Ogundipe, *(2014)* examined the effects of oil price, external reserves and interest rate on exchange rate volatility in Nigeria using annual data covering the period 1970 to 2011. It was observed that a proportionate change in oil price leads to a more than proportionate change in exchange rate volatility in Nigeria; which implies that exchange rate is susceptible to changes in oil price.Ebele, *(2015)* investigated the impact of crude oil price volatility on economic growth in Nigeria from 1970 to 2014. The study aims at extending the frontier of knowledge by estimating the impact of the oil price volatility on the Nigerian economic growth using aggregate demand framework that theoretically connect analytical variables, rather than just explaining output behaviour by oil price and host of arbitrarily variables as done by earlier studies. The study found that, oil price volatility (OPV) has negative impact on the economic growth while other variables such as crude oil price, oil revenue and oil reserves have positive impact on the Nigerian economy. Alhassan and Kilishi, *(2016)* examined the oil price-macroeconomic volatility in Nigeria. Mainly, the paper employed GARCH model and its variants (GARCH-M, EGARCH and TGARCH) with daily, monthly and quarterly data. The findings reveal that all the macroeconomic variables considered (real gross domestic product, interest rate, exchange rate and oil price) are highly volatile; the asymmetric models (TGARCH and EGARCH) outperform the symmetric models (GARCH (1 1) and GARCH – M); and oil price is a major source of macroeconomic volatility in Nigeria.

4 Theoretical framework and methodology

4.1 Theoretical framework

The theoretical framework for this study is based on exhaustible resources theory propounded by Hotelling in 1931. The paper advocated the need to price oil and other fossil resources in a way that recognizes the temporariness of their availability. According to this theory, the price becomes a user cost or depletion charges which compensate for the fact that future generation are denied access to the commodity. This price may or may not be consistent with the equilibrium outcome of demand and supply. Similarly, according to the derived demand theory proposed by Marshall, the demand schedule for any factor of production of a final product can be driven from the final product, assuming an unchanged demand schedule for a final product and given supply prices for other factors of production. The supply increase of other factors held constant and increase in the demand of the final

goods would lead to an increase in the demand of a given factor of production. Blomberg and Harris *(1995)* agree that supply shock (or distribution problem) will lead to higher price impacts when the derived demand is inelastic. Marshall notes that the derived of a factor will be more inelastic when (1) the factors were more essential in the production process of the final product (2) The more price inelastic is the demand for final production (3) the smaller the fraction of total cost that is contributed by the factor, and the more price inelastic is the supply (distribution) of the other factor.

4.2 Model, estimation techniques and data

From the theoretical framework above which is based on exhaustible resources theory and the models will be specified in other to capture human welfare variables according to Glewwe *(1991)* and Adagunodo, *(2013)* who investigated the determinant of household welfare in Cote d'Ivoire:

$$HDI = f(PMS, AGO \& DPK). \quad (4.1)$$

In other to make this work different and unique from the past studies, two control variables will be introduced where and these are inflation rate and interest rate.

$$HDI = f(PMS, AGO, DPK, INF \& INT), \quad (4.2)$$

Where:

The dependent variable is:

HDI - Human Development Index (measure in %);

The explanatory variables are:

PMS - Premium Motor Spirit per litre (Commonly Referred to as Petrol or Fuel or especially in the U.S as Gas or Gasoline);

AGO - Automotive Gas Oil litre (popularly known as Diesel);

DPK - Dual Purpose Kerosene litre (popularly known as Kerosene);

INF - Inflation Rate (using consumer's price index and it is measure in %);

INT - Interest Rate (measure in %).

The linear regression model is given below in equation (3)

$$HDI = a0 + a1PMS + a2AGO + a3DPK + a4INF + a5INT + u. \quad (4.3)$$

The natural logs of the variables are taken in order to normalize them.

The log-log form of the mode will be as follows:

$$HDI = a0 + a1LNPMS + a2LNAGO + a3LNDPK + a4INF + a5INT + u. \quad (4.4)$$

To examine the short-run and long-run relationship between premium motor spirit price, automotive gas oil price and dual purpose kerosene price and human welfare in Nigeria, the short-run and long-run model are specified below:

$$HDI = a0 + a1LNPMS + a2LNAGO + a3LNDPK + a4INF + a5INT + \beta1HDIt\text{-}1 + \\ + \beta2LNPMSt\text{-}1 + \beta3LNAGOt\text{-}1 + \beta4LNDPKt\text{-}1 + \beta5INFt\text{-}1 + \beta6INTt\text{-}1 + u \quad (4.5)$$

The data that will be used for this study are basically time series data covering 1990 to 2015, a period of thirty-four (26) years because of the unavailability of data for some of the variables. The data will be sourced from Central Bank of Nigeria's (CBN) Statistical Bulletin (various editions) and World Bank's World Development Indicators (WDI). This particular scope was chosen in order to ascertain the petroleum pump price on human welfare during the period of military and civilian regimes. The variables are human development index (measure in %), premium motor spirit per litre (commonly referred to as petrol or fuel or especially in the U.S as gas or gasoline), automotive gas oil litre (popularly known as diesel), dual purpose kerosene litre (popularly known as kerosene), inflation rate (using consumer's price index and it is measure in %) and interest rate (measure in %).Different diagnostic test will be carry out by using auto-regressive distributive lag (ARDL).

5 Empirical analysis

This section presents the estimated results and it is divided into two which are preliminary analyses and diagnostic test. The preliminary analyses includes descriptive statistics analysis, the correlation analysis, unit root and co-integration test are carried out while diagnostic test include auto-regressive distributive lag (ARDL).

5.1 Summary Statistics Result

This is use to know whether the variables are normally distributed or not through skewness, kurtosis and Jargue-Bera test.

Table 5.1

Summary Statistics Output

	HDI	LOG(PMS)	LOG(AGO)	LOG(DPK)	INF	INT
Mean	40.42577	3.167925	5.614137	3.821289	56.04571	13.38500
Median	40.70000	3.473488	5.624018	3.789177	42.89056	13.50000
Maximum	47.10000	4.976734	5.743003	5.101451	145.7960	26.00000
Minimum	31.50000	-0.510826	5.493061	2.496506	2.435804	6.130000
Std. Dev.	5.396668	1.596624	0.065741	0.642097	45.18336	4.250804
Skewness	-0.227419	-1.138860	-0.053918	0.187347	0.591306	0.810594
Kurtosis	1.592579	3.482478	2.428618	2.763179	2.087174	4.255990
Jarque-Bera	2.370021	5.872527	0.366282	0.212853	2.417806	4.556241
Probability	0.305743	0.053064	0.832651	0.899041	0.298525	0.102477
Sum	1051.070	82.36606	145.9675	99.35352	1457.188	348.0100
Sum Sq. Dev.	728.1006	63.73018	0.108046	10.30723	51038.39	451.7335
Observations	26	26	26	26	26	26

Source: author's Computation

Note: *, ** and *** imply rejection of null hypothesis for normality using JB statistic

Descriptive statistics were performed to examine if the explanatory variables and the dependent variable exhibit time varying volatility and leptokurtosis characteristics. The variables of the study are examined because these variables determine the estimation technique for the study. The statistics of the variables series are displayed in Table 5.1 below.

The statistics show that the J-B value of 2.370021 for human development index, 5.872527 for premium motor spirit price, 0.366282 for automotive gas oil, 0.212853 for dual purpose kerosene price, 2.417806 for inflation rate and 4.556241 for interest rate respectively deviated from normal distribution. Similarly, skewness and kurtosis represent the nature of departure from normality. The human development index, premium motor spirit price, automotive gas oil, dual purpose kerosene price, inflation rate and interest rate for skewness are -0.227419, -1.138860, -0.053918, 0.187347, 0.591306 and 0.810594 respectively and they reflects positive skewness for dual purpose kerosene price, inflation rate and interest rate while human development index, premium motor spirit price and automotive gas oil reflects negative skewness. The value for kurtosis are 1.592579, 3.482478, 2.428618, 2.763179, 2.087174 and 4.556241 respectively and this suggests that there are no peakedness in the values of all the series. The coefficients of kurtosis of all the series are less than three except for premium motor spirit price and interest rate which have a value that is more than three. This demonstrates significant platykurtic while premium motor spirit price and interest rate are leptokurtic. A distribution with a coefficient larger than 3 is said to be leptokurtic and one with a coefficient smaller than 3 is platykurtic. The means of all the series exhibit positive average values and inflation rate has the highest yearly mean value of 56.04571 while premium motor spirit price has the lowest yearly mean value of 3.167925.

5.2 Correlation Matrix

In other to know that there is no multicolinearity among the explanatory variable, correlation analysis was carried out. Correlation also shows the degree of association among the variables.

Table 5.2

Correlation Matrix Output

	HDI	PMS	AGO	DPK	INF	INT
HDI	1					
PMS	0.87969	1				
AGO	0.32373	0.24026	1			
DPK	0.72052	0.09828	0.22006	1		
INF	0.93229	0.06542	0.26589	0.09301	1	
INT	-0.71171	-0.04631	-0.04583	-0.59280	-0.70541	1

Source: author's Computation

The relationship between human welfare and premium motor spirit price is 0.87969 which mean that there is a strong association between the two variables; also the relationship between human welfare and automotive gas oilprice is a weak positive which a figure of 0.32373 and the association between human welfare and dual purpose kerosene priceis 0.72052 which mean that there is a strong association between the them while the correlation between the relationship between human welfare and inflation rateis 0.93229 which implied that that there is a strong positive between them. The correlation co-efficient of -0.71171 means that the relationship between human welfare and interest rate is a strong negative relation.Premium motor spirit price and automotive gas oil has a weak positive correlation, premium motor spirit price and dual purpose kerosene pricehas a weak positive correlation

and premium motor spirit price and inflation ratehas a weak positive correlation while premium motor spirit price and interest rate has a weak negative correlation. Automotive gas oiland dual purpose kerosene pricehas a weak positive correlation and automotive gas oil and inflation ratehas a weak positive correlation while automotive gas oil and interest rate has a weak negative correlation. Dual purpose kerosene priceand inflation ratehas a weak positive correlation while dual purpose kerosene priceand interest rate has a weak negative correlation while the correlation between inflation rateand interest rate has a weak negative correlation. Therefore, the result showed that there is no multicolinearity among the explanatory variable

5.3 Unit Root Test

The time series behaviour of each of the series is presented in Tables 5.3, using the Augmented Dickey Fuller test (ADF) at both level and first difference of the series.

Table 5.3

ADF (Augmented Dickey Fuller) Unit Root Test Result

Level			Difference		Status
Variable	t*	ADF Critical Value	t*	ADF Critical value	
HDI	-2.998064	-6.268360			I(0)
LN(PMS)	-2.986225	-2.479796	-2.991878	-4.167986	I(1)
LN(AGO)	-2.986225	-2.633079	-2.991878	-6.003425	I(1)
LN(DKP)	-2.986225	-0.893167	-2.998064	-4.924422	I(1)
INF	-2.986225	-0.669519	-2.991878	-3.867178	I(1)
INT)	-2.986225	-2.564616	-2.998064	-5.727238	I(1)

Source: author's Computation

The table reports that none of the time series data of premium motor spirit price, automotive gas oil, dual purpose kerosene price, inflation rate and interest ratehave t-values greater ADF that is t* > ADF statistics indicating unit root and hence the application of the differencing technique. During the differencing, premium motor spirit price, automotive gas oil, dual purpose kerosene price, inflation rate and interest ratevariables became stationary at 1st difference as their t* < ADF statistics except human development index which was stationary at level and hence the generation of first difference data for the analysis. Given that the ADF test statistic of the variables at first difference < critical values at1%, we conclude that there is no unit root with the time series except human development index. Therefore, the time series are stationary.

5.4 ARDL Bounds Test for Co-Integration

The ARDL method which is also referred to as bound test produces reliable estimates for small sample size and provides a check for robustness of the results and for estimation of co-integrating relationship that has a combination of I(1) and I(0) but with no existence of I(2) since the stationarity test confirmed it.

Table 5.4

ARDL Bounds Test for Co-Integration

Variables	F-Statistics	Co-integration
F(HDI/PMS, AGO, DPK, INF & INT)	4.400628*	Co-integration
Critical value	Lower Bound	Upper Bound
1%	5.018	6.610
5%	3.548	4.803
10%	2.933	4.020

Source: Author's Computation

Notes: *** Statistical significance at 1% level; ** Statistical significance at 5% level; * Statistical significance at 10% level.

The lag length k=1 was selected based on the Schwarz criterion (SC). Critical values are obtained from Narayan (2005) case III for 26 observations. The number of regressors is 5.

Therefore, the empirical findings lead to the conclusion that a long-run relationship between human development index, premium motor spirit per litre, automotive gas oil litre, dual purpose Kerosene litre,inflation rate and interest rate exists. Next step is to examine the marginal impacts of premium motor spirit per litre, automotive gas oil litre, dual purpose Kerosene litre,inflation rate and interest rate on human welfare in Nigeria.

Table 5.5

Estimated Long-Run Coefficients Using the ARDL Approach

ARDL(1,1,1,1,1) selected based on Akaike Information Criterion			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	-16.2814	2.5849	-6.2987[.000]*
LN(PMS)	-.15299	.028805	-5.31141[.001]*
LN(AGO)	-.07345	.11335	-.64796[.523]
LN(DPK)	-.47140	.25023	-1.8838[.097]***
INF	-.00877	.026861	-.32631[.753]
INT	-.00528	.010015	-.52683 [.613]

Source: Author's Computation

Note:*, ** and *** denote 1%, 5% and 10% level of significance respectively

From the result of the long-run ARDL in Table 5.5, premium motor spirit price and dual purpose kerosene price are statistically significant at 1% and 10% and are negatively related to human welfare in Nigeria. That is, in the long run, if premium motor spirit price and dual purpose keroseneprice increase by 1%, there will be a respective 0.15299% and 0.471399% decrease in human welfare in Nigeria. The result also suggests that automotive gas oil, inflation rate and interest rateare statistically insignificant they are negatively related to human welfare. This then explains that in the long run, if automotive gas oil increases by 1%, there will be a decrease of 0.073447% in human welfare and also if inflation rate increases by 1%, there will be a decrease of 0.00877% in human welfare in Nigeria while a percentage increase in interest rate will lead to a decrease of 0.00528% in human welfare in Nigeria.

Table 5.6

Error Correction Representation for the Selected ARDL Model

ARDL(1,1,1,1,1) selected based on Akaike Information Criterion			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLN(PMS)	-.71735	.16390	-4.3766[.000]*
dLN(AGO)	-.00262	.00532	-.49320[.629]
dLN(DPK)	-.62562	.21434	-2.9188[.010]**
INF	-.050310	.02305	-2.1829[.044]**
INT	-.077260	-062368	-1.2388[.233]
ecm(-1)	-.71453	.14085	-5.0729[.000]*
R-Squared	.71193	R-Bar-Squared	.69361
S.E. of Regression	.17710	F-Stat. F(6,26)	8.8754[.000]
Mean of Dependent Variable	.014189	S.D. of Dependent Variable	.27446
Residual Sum of Squares	.81552	Equation Log-likelihood	15.1710
Akaike Info. Criterion	7.1710	Schwarz Bayesian Criterion	1.0656
DW-statistic	1.8780		

Source: Author's Computation

The result shows an ECM value of -0.71453 which is otherwise referred to as the speed of adjustment. The speed of adjustment is significant at 1% percent level considering its standard error. Approximately 71.45% of disequilibrium from the previous year's shock converge back to the long-run equilibrium in the current year. Also, the ECM is correctly signed and statistically significant with the speed of convergence to equilibrium at 71.45% percent. That is 71.45 percent of the short run inconsistencies are being corrected and incorporated into the long run relationship. The implication is that the present value of human welfare will adjust to changes in premium motor spirit price and dual purpose kerosene price, automotive gas oil, inflation rate and interest rate.

The result also shows that premium motor spirit price and dual purpose kerosene price, automotive gas oil, inflation rate and interest rateare negatively related to human welfare in the short run. This implies that a 1% increase in premium motor spirit price will lead to a decrease of 0.71735% in human welfare in Nigeria. In the same vein, the co-efficient of automotive gas oil price is -0.00262 and this implies that a percentage increase in automotive gas oil price will bring about 0.00262% decrease in human welfare. If dual purpose kerosene price increases by 1%, there will be a decrease of 0.62562% in human welfare and also if inflation rate increases by 1%, there will be a decrease of 0.050310% in human welfare in Nigeria while a percentage increase in interest rate will lead to a decrease of 0.077260% in human welfare in Nigeria. Therefore, in the short-run, premium motor spirit price and dual purpose kerosene price and inflation rate are statistically significant in determine human welfare while automotive gas oil and interest rate are statistically insignificant in determine human welfare in the short-run.

The R- squared value of 0.71193 showed that 71.1% of the dependent variable is explained by the independent variable, while the value of the R- Bar-squared of 0.69361 showed that 69.36% of the dependents variable is determined by the independent variable. Also, the Durbin Watson value of 1.8780 can be approximated to 2, this shows that there is no auto-correlation in the model. Also, the F-statistic of 8.8754 [P<.05] implied that the overall

model is significant. The result of this research work is in line with the finding of Glewwe, (1991) and Adagunodo, (2013).

5.5 Diagnostic Tests Result

The diagnostic test in table 5.7 below shows that the serial correlation is insignificant in the LM version and also insignificant in the F version, so we can assume that there is no auto-correlation according to the LM and F version. Similarly the functional form is insignificant (no issue); normality is insignificant (no issue) and hetroskedasticity is insignificant (no issue). Hence there is no apparent issue with the model.

Table 5.7

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1) = 1.6802[.195]	F(1,25)= 1.4485[.239]
B:Functional Form	CHSQ(1) = .78734[.375]	F(1,25)= .59234[.449]
C:Normality	CHSQ(2) = 1.0681[.578]	Not applicable
D:Heteroscedasticity	CHSQ(1) = 2.6647[.112]	F(1,32)= 2.6401[.110]

Source: Author's Computation

5.5.1 CUSUM Hypothesis Test Analysis

The CUSUM and CUSUMSQ hypothesis testing is important as we need to see if there is any recursive residuals because of structural break as ARDL is sensitive to it.Since the line of CUSUM and CUSUMSQ test is within the red and green lines, the model is stable and the model does not have any serial correlation. This means that there is no issue of recursive residuals in terms of mean (in first CUSUM chart) and in terms of variance (in second CUSUMSQ chart).

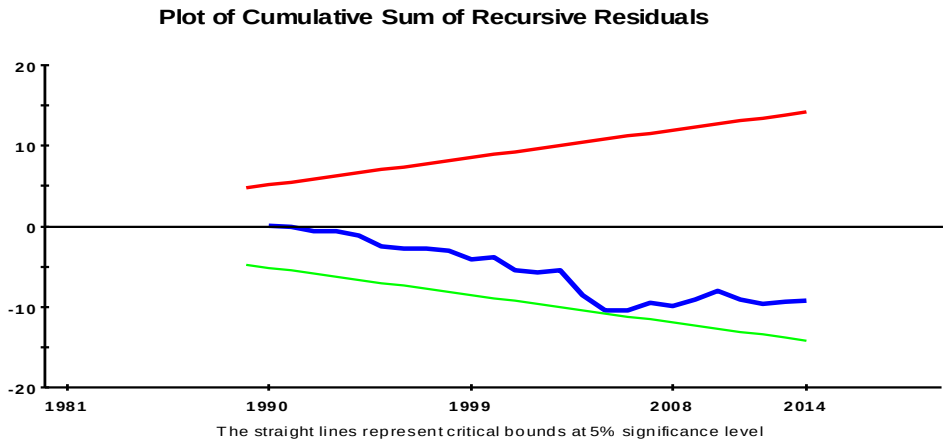

Fig. 5.1. CUSUM Hypothesis Test

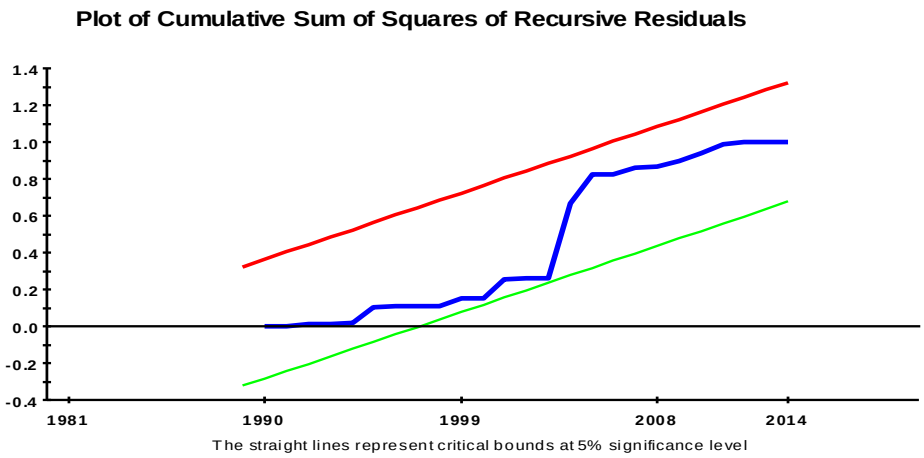

Fig. 5.2. CUSUMSQ Hypothesis Test

6 Summary and conclusion

The study concluded that as premium motor spirit price and dual purpose kerosene price and inflation rate increases, human welfare will fall and vice versa. Therefore for human welfare to increase, there must be a fall in premium motor spirit price and dual purpose kerosene price and inflation rate in Nigeria. The study recommended that Government and it agencies should ensure that petroleum pump prices should be regulated because they have a long way on the market. An increase in the price of petroleum products will lead to market failure because most products use either of these products. Since inflation rate worsen the welfare of people, the policy maker should find a way of control inflation in the system so that the welfare of the people will improve (better-off).

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